NIST Develops a High Performance Secondary Ion Mass Spectrometric Method to Search for Particulate Nuclear Material Over Large Areas

NIST has developed high performance Secondary Ion Mass Spectrometric method to evaluate of samples collected by the International Atomic Energy Agency (IAEA) for the presence of nuclear material. This methodology has the ability to determine the isotopic composition of detected material, which is a key analytical capability used for monitoring signatories of the Nuclear Non-proliferation Treaty.

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NIST researchers are developing a method that uses a large radius SIMS instrument (ims-1270) to scan broad areas of prepared samples searching for isotopes of uranium (or other elements of interest) and measuring their isotopic ratios. A method of analysis currently used for this purpose employs the conventional magnetic sector secondary ion mass spectrometers (SIMS). However, the ims-1270 has a number of performance benefits compared to conventional SIMS instruments including: higher secondary ion transmission, higher mass resolution and a multi-collector secondary ion detection system.

The large radius SIMS instrument (ims-1270) allows the NIST team to scan larger areas for multiple masses at faster speeds with greater sensitivity while adding confidence to the identification of the detected species.

The figure shows data from a sample that was scanned for the presence of ^{235}U. Sample areas somewhat larger than 5 mm x 5 mm can be scanned in ≈ 8 hours. Particles located from the image below can be re-located and analyzed further. Up to 5 masses can be monitored simultaneously with no loss in analysis speed compared to more conventional single mass detection systems.

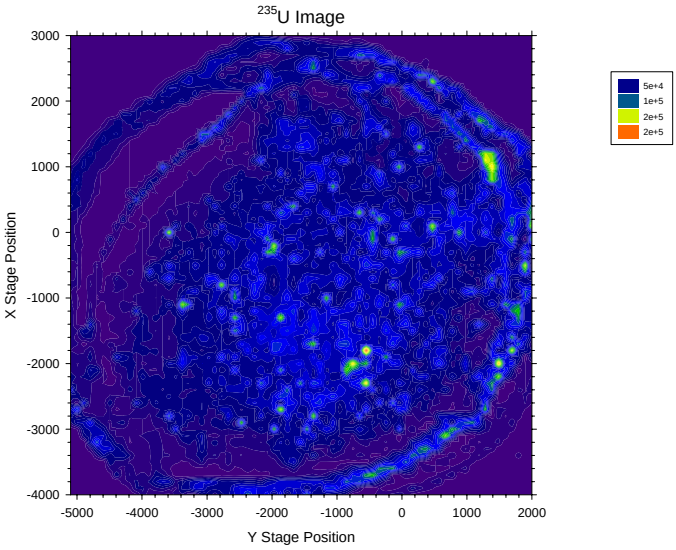

Figure 1.
Mass Spectral image of ^{235}U from large sample area.

Future Plans: Further programming and refinement of this method will be performed in the coming year. Plans exist to expand and enhance the abilities of this new method to provide more information over a larger area of the sample. In addition, we will be testing mixtures of standard particles to gauge the efficacy of the method.

Successful implementation of this method will result in significant improvements in analysis speed and sensitivity over current analytical methods used for international treaty verification by the IAEA.